In The Claims

Please cancel claim 3 without prejudice to or disclaimer of the subject matter contained therein.

Please amend the claims as follows:

1. (Amended) A method for restoring a compressed image of an image processing system, comprising:

a step for defining a smoothing functional having a smoothing degree of an image and reliability for an original image by pixels having an identical property in image block units; and

a step for computing a restored image by performing a gradient operation on the smoothing functional in regard to the original image;

wherein the smoothing functional M(f) comprises a sum of a smoothing functional M_{VB}(f) for pixels positioned at the boundary of a block in a vertical direction, a smoothing functional M_{VW} (f) for pixels positioned inside the block in a horizontal direction, a smoothing functional M_{HB} (f) for pixels positioned at the boundary of a block in a horizontal direction, a smoothing functional M_{HW} (f) for pixels positioned inside the block in a horizontal direction, a smoothing functional M_T(f) for pixels moved and compensated in the temporal section, "f" indicating the original image.

32

3 ~~4~~. (Amended) The method according to claim 1, wherein the smoothing functionals $M_{VB}(f)$, $M_{HB}(f)$, $M_{VW}(f)$, $M_{HW}(f)$, $M_T(f)$ are defined as;

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$$M_{VB}(f) = \|Q_{VB} f\|^2 + \alpha_{VB}\|g - f\|^2_{W1}$$
$$M_{HB}(f) = \|Q_{HB} f\|^2 + \alpha_{HB}\|g - f\|^2_{W2}$$
$$M_{VW}(f) = \|Q_{VW} f\|^2 + \alpha_{VW}\|g - f\|^2_{W3}$$
$$M_{HW}(f) = \|Q_{HW} f\|^2 + \alpha_{HW}\|g - f\|^2_{W4}$$
$$M_T(f) = \|Q_T f\|^2 + \alpha_T\|g - f\|^2_{W5}$$

Q_{VB}, Q_{VW}, Q_{HB}, Q_{HW}, Q_T indicating high pass filters for smoothing the respective pixels, α_{VB}, α_{VW}, α_{HB}, α_{HW}, α_T being regularization parameters, g being a reconstructed image, and W1, W2, W3, W4, W5 indicating diagonal matrixes for determining whether each group has an element.

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16 ~~14~~. (Amended) An apparatus for restoring a compressed image of an image processing system, comprising:

a decoder for decoding a coded image signal, and for outputting information of the restored image, such as the decoded image, a quantization variable, a macro block type and a motion vector; and

a post processing unit for including the information of the restored image inputted from the image decoder, for defining a smoothing functional including a sum of a smoothing functional $M_{VB}(f)$ for pixels positioned at the boundary of a block in a vertical direction, a smoothing functional $M_{VW}(f)$ for pixels positioned inside the block in a horizontal direction, a smoothing

33

functional M_{HB} (f) for pixels positioned at the boundary of a block in a horizontal direction, a smoothing functional M_{HW} (f) for pixels positioned inside the block in a horizontal direction, a smoothing functional M_T(f) for pixels moved and compensated in the temporal section, "f" indicating the original image, and for performing a gradient operation on the smoothing functional in regard to the original image,

the smoothing functional including a regularization parameter having weight of reliability for the original image.

Please add the following claims:

--~~15~~ 17. (NEW) A method for restoring a compressed image of an image processing system, comprising:

a step for defining a smoothing functional having a smoothing degree of an image and reliability for an original image by pixels having an identical property in image block units;

a step for computing a restored image by performing a gradient operation on the smoothing functional in regard to the original image; and

a step for computing an iterative solution in regard to the restored image, after computing the restored image.

~~16~~ 18. (NEW) The method according to claim ~~15~~ 17, wherein the step for defining the smoothing functional divided the pixels according to their position, horizontal direction, vertical direction and smoothing variation in a temporal section.

~~17~~ 19. (NEW) The method according to claim ~~15~~ 17, wherein the smoothing functional M(f) comprises a sum of a smoothing functional $M_{VB}(f)$ for pixels positioned at the boundary of a block in a vertical direction, a smoothing functional $M_{VW}(f)$ for pixels positioned inside the block in a horizontal direction, a smoothing functional $M_{HB}(f)$ for pixels positioned at the boundary of a block in a horizontal direction, a smoothing functional $M_{HW}(f)$ for pixels positioned inside the block in a horizontal direction, a smoothing functional $M_T(f)$ for pixels moved and compensated in the temporal section, "f" indicating the original image.

35

~~18~~ 20. (NEW) The method according to claim ~~17~~ 19, wherein the smoothing functionals $M_{VB}(f)$, $M_{HB}(f)$, $M_{VW}(f)$, $M_{HW}(f)$, $M_T(f)$ are defined as;

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$$M_{VB}(f) = \|Q_{VB} f\|^2 + \alpha_{VB}\|g - f\|^2_{W1}$$
$$M_{HB}(f) = \|Q_{HB} f\|^2 + \alpha_{HB}\|g - f\|^2_{W2}$$
$$M_{VW}(f) = \|Q_{VW} f\|^2 + \alpha_{VW}\|g - f\|^2_{W3}$$
$$M_{HW}(f) = \|Q_{HW} f\|^2 + \alpha_{HW}\|g - f\|^2_{W4}$$
$$M_T(f) = \|Q_T f\|^2 + \alpha_T\|g - f\|^2_{W5}$$

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Q_{VB}, Q_{VW}, Q_{HB}, Q_{HW}, Q_T indicating high pass filters for smoothing the respective pixels, α_{VB}, α_{VW}, α_{HB}, α_{HW}, α_T being regularization parameters, g being a reconstructed image, and W1, W2, W3, W4, W5 indicating diagonal matrixes for determining whether each group has an element.

~~19~~ 21. (NEW) The method according to claim ~~15~~ 17, wherein the step for computing the restored image comprises a step for approximating the regularization parameter by applying a set theoretic, and it is presumed that the quantization variables of the DCT region are regular in each macro block, and also presumed that the DCT quantization errors have the Gaussian distribution property in the spatial section.

~~20~~ 22. (NEW) The method according to claim ~~19~~ 21, wherein the regularization parameters are approximated as;

$$\alpha_{VB} = \frac{\|Q_{VB} f\|^2}{\|g - f\|^2_{W1}} = \frac{\|Q_{VB} g\|^2}{\|g - f\|^2_{W1}} = \frac{\|Q_{VB} g\|^2}{\sum_n \sum_m W_1(m,n) Qp^2(m,n)}$$

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34

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$$\alpha_{HB} = \frac{\|Q_{HB} f\|^2}{\|g-f\|^2_{W2}} = \frac{\|Q_{HB} g\|^2}{\|g-f\|^2_{W2}} = \frac{\|Q_{HB} g\|^2}{\sum_n \sum_m W_2(m,n) Qp^2(m,n)}$$

$$\alpha_{VW} = \frac{\|Q_{VW} f\|^2}{\|g-f\|^2_{W3}} = \frac{\|Q_{VW} g\|^2}{\|g-f\|^2_{W3}} = \frac{\|Q_{VW} g\|^2}{\sum_n \sum_m W_3(m,n) Qp^2(m,n)}$$

$$\alpha_{HW} = \frac{\|Q_{HW} f\|^2}{\|g-f\|^2_{W4}} = \frac{\|Q_{HW} g\|^2}{\|g-f\|^2_{W4}} = \frac{\|Q_{HW} g\|^2}{\sum_n \sum_m W_4(m,n) Qp^2(m,n)}$$

$$\alpha_{T} = \frac{\|Q_{T} f\|^2}{\|g-f\|^2_{W5}} = \frac{\|Q_{T} g\|^2}{\|g-f\|^2_{W5}} = \frac{\|Q_{T} g\|^2}{\sum_n \sum_m W_5(m,n) Qp^2(m,n)}$$

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Q^2_p (m,n) indicating a quantization variable of a macro block including an (m,n)th pixel of a two-dimensional image.

~~21~~ 23. (NEW) The method according to claim ~~15~~ 17, wherein a local minimizer of the smoothing functional is a global minimizer.

~~22~~ 24. (NEW) The method according to claim ~~15~~ 17, wherein the regularization parameter indicates a ratio of a smoothing degree of the image and reliability for the original image.

~~23~~ 25. (NEW) The method according to claim ~~15~~ 17, wherein the iterative solution f_{k+1} is represented by;

$f_{k+1} = f_k + \beta[Ag - Bf_k]$,

$A = \alpha_{VB}W_1 + \alpha_{HB}W_2 + \alpha_{VW}W_3 + \alpha_{HW}W_4 + \alpha_T W_5$

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$B = (Q^T{}_{VB}Q_{VB} + Q^T{}_{HB}Q_{HB} + Q^T{}_{VW}Q_{VW} + Q^T{}_{HW}Q_{HW} + Q^T{}_TQ_T) + A$

and, β is a relaxation parameter having a convergence property, and computed at the range of $0 < \beta < \dfrac{2}{1+\max_i \lambda_i(A)}$, an eigen value $\lambda(A)$ of the matrix A being replaced by a fixed value.

13 ~~24~~. NEW) The method according to claim 1, wherein a predetermined threshold value is set in computing an iterative solution, an image obtained after iteration is compared with the previously-set threshold value, and it is determined whether the iteration technique is continuously performed according to a comparison result, or the iteration is finished after the iteration technique is performed as many as a previously-set number.

14 ~~25~~. (NEW) The method according to claim 1, further comprising a step for obtaining a mapped image by projecting a two-dimensional DCT coefficient of the restored image corresponding to a computed iterative solution, and for performing an inverse DCT on the mapped image.

15 ~~26~~. (NEW) The method according to claim 14 ~~25~~, wherein the step for obtaining the mapped image is mapping a projected restored image $P(F_{k+1}(u,v))$ to $G(u,v)$-Qp when the DCT coefficient of the restored image $F_{k+1}(u,v)$ is smaller than $G(u,v)$-Qp, mapping the projected restored image $P(F_{k+1}(u,v))$ to $G(u,v)$+Qp

when $F_{k+1}(u,v)$ is greater than $G(u,v) + Qp$, and otherwise mapping the projected restored image $P(F_{k+1}(u,v))$ as it is, $G(u,v)$ indicating a two-dimensional DCT coefficient obtained by performing the DCT on the reconstructed image, and Qp indicating quantization information.

26

~~27~~. (NEW) An apparatus for restoring a compressed image of an image processing system, comprising:

a decoder for decoding a coded image signal, and for outputting information of the restored image, such as the decoded image, a quantization variable, a macro block type and a motion vector; and

a post processing unit for including the information of the restored image inputted from the image decoder, for defining a smoothing functional including a smoothing degree of the image and reliability of an original image block unit, and for performing a gradient operation on the smoothing functional in regard to the original image,

the smoothing functional including a regularization parameter having weight of reliability for the original image.--